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(54) Coating machines

(57) A coating machine with counter-flow (14) and parallel-flow (13) air conduction is used for coating tablets, granules, pellets and dragees with one or more coating compositions. The cores to be coated are arranged in a rotatably driven, perforated drum (1) which comprises an air conducting channel (2) surrounding the drum at its outer periphery, which air channel is provided with air from an air supply fixed to the housing, with air streams differently directed into the drum. In order to provide an operationally reliable, positively controlled and easy-to-clean air distributor, an annular distributor plate (31) is mounted rotatably on annular flanges (34) fixed to the housing, the distributor plate having slots (32) therein which are connected to the air connections (44) of the air supply, and the annular flange is in turn connected in an airtight manner to the air conducting channel of the drum by part-annular chambers (23a, 23b, 23c) separate from each other.

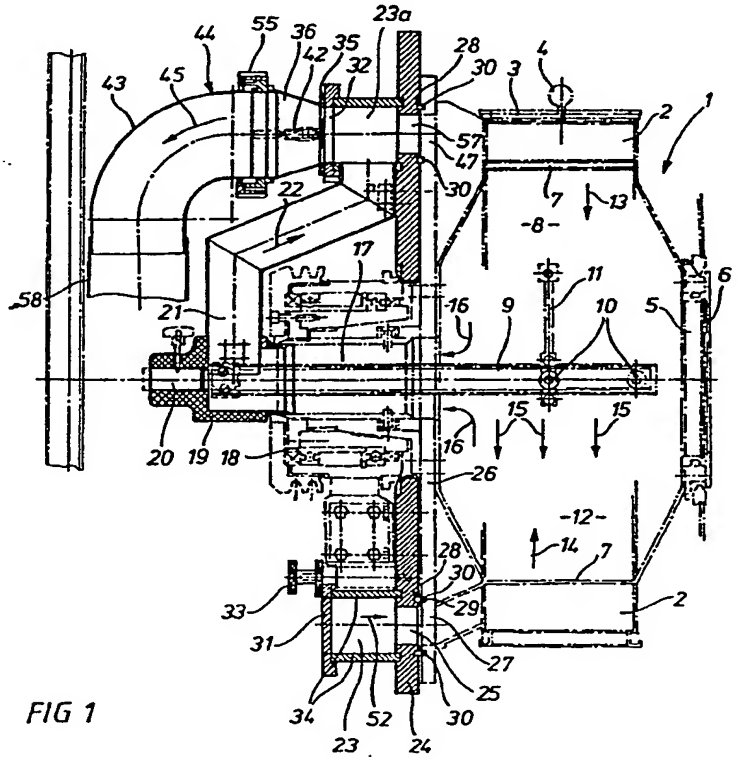

FIG 1

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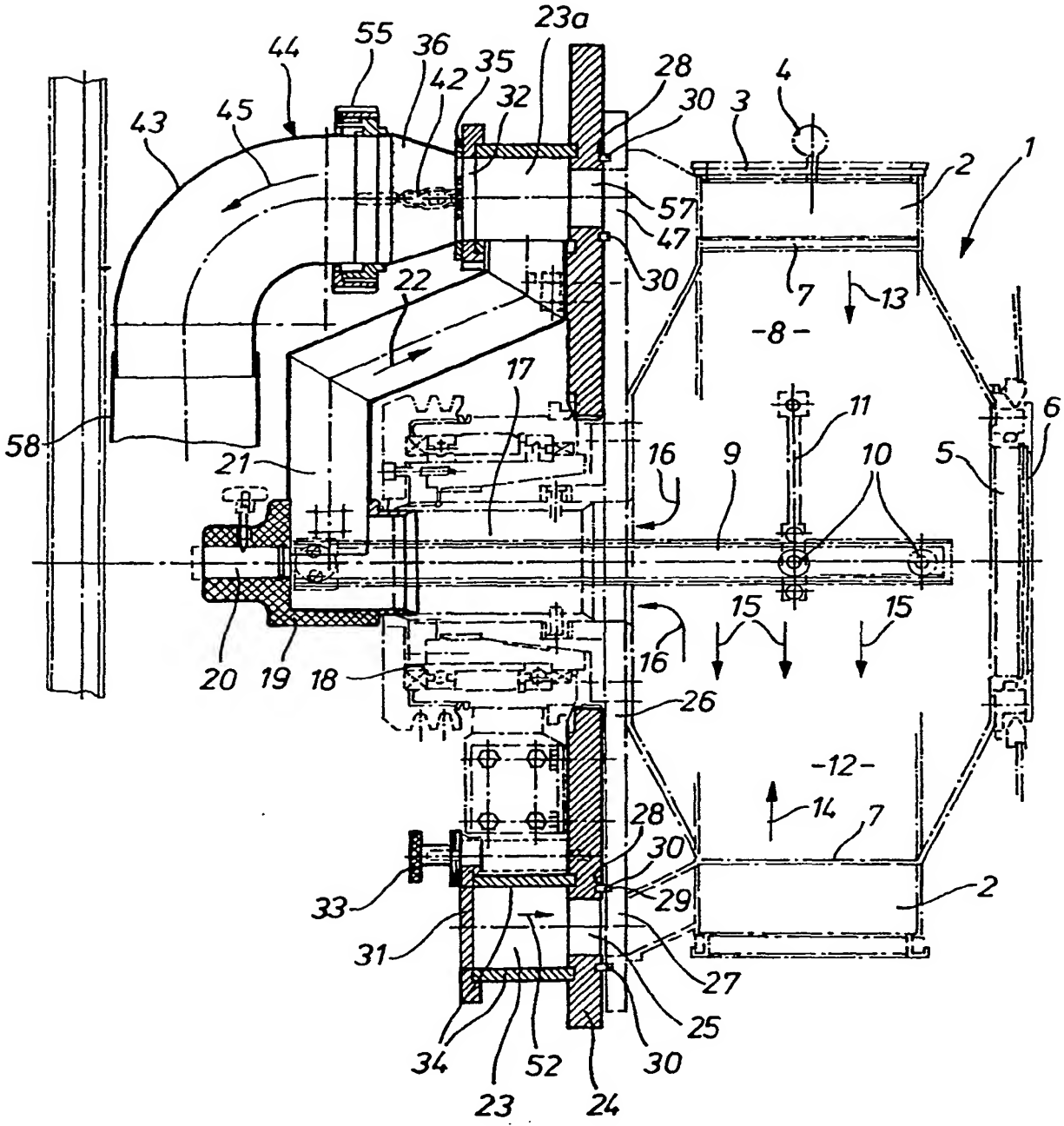

FIG 1

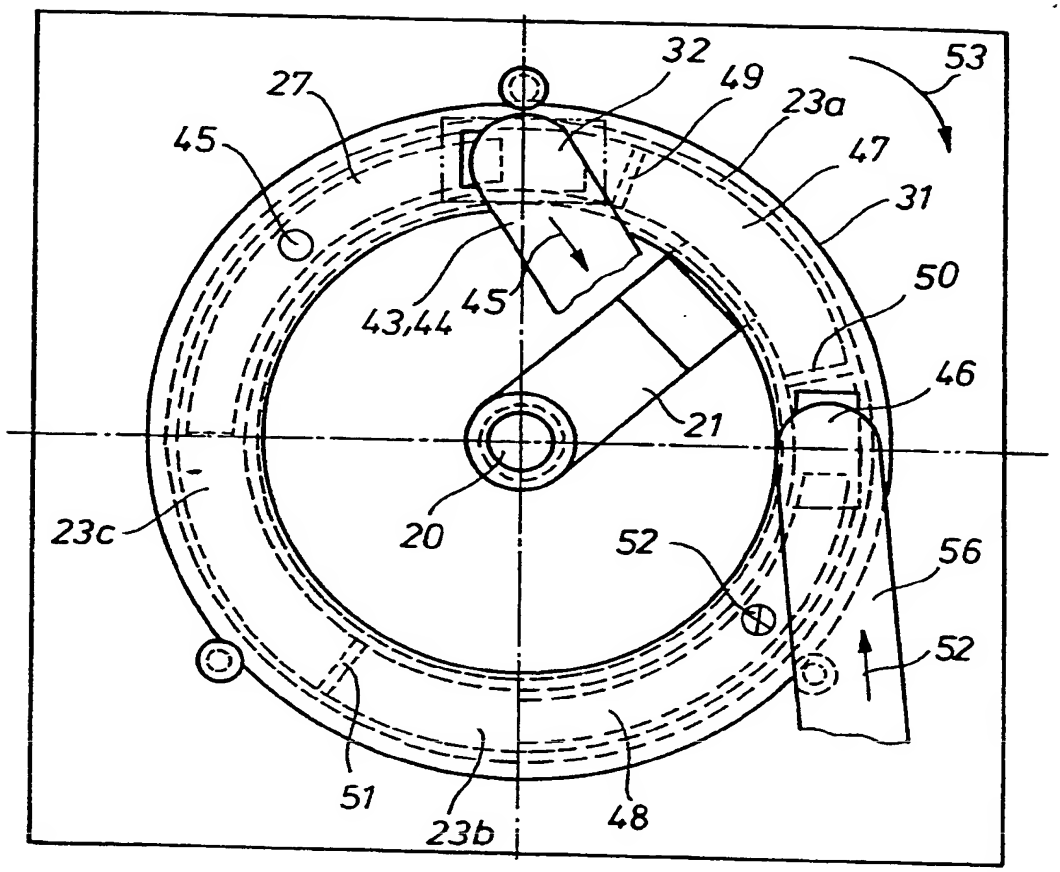

FIG 3

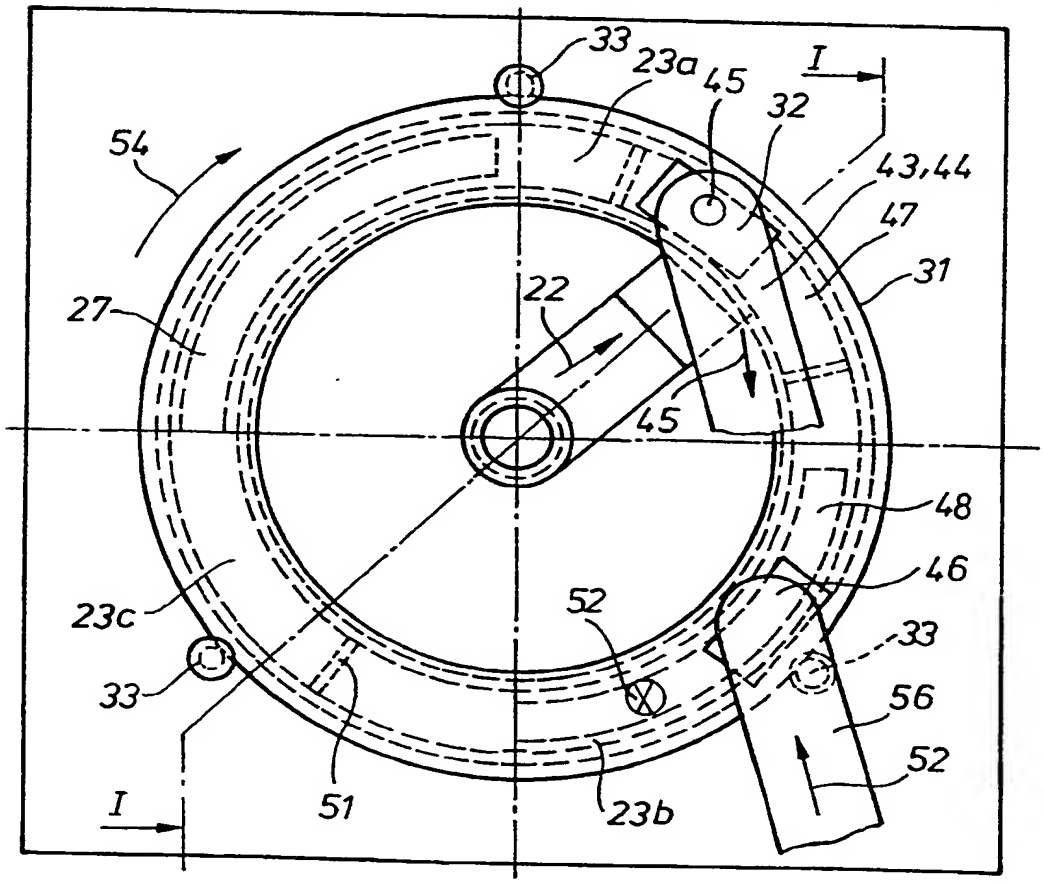

FIG 4

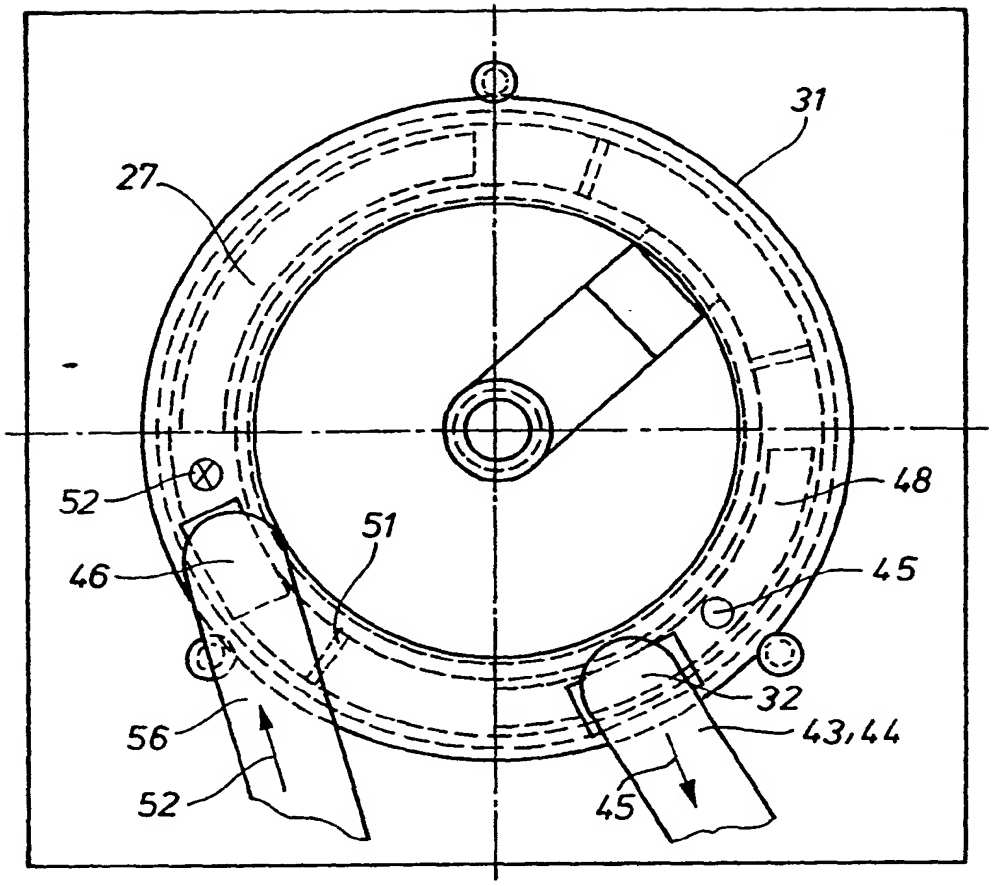

FIG 5

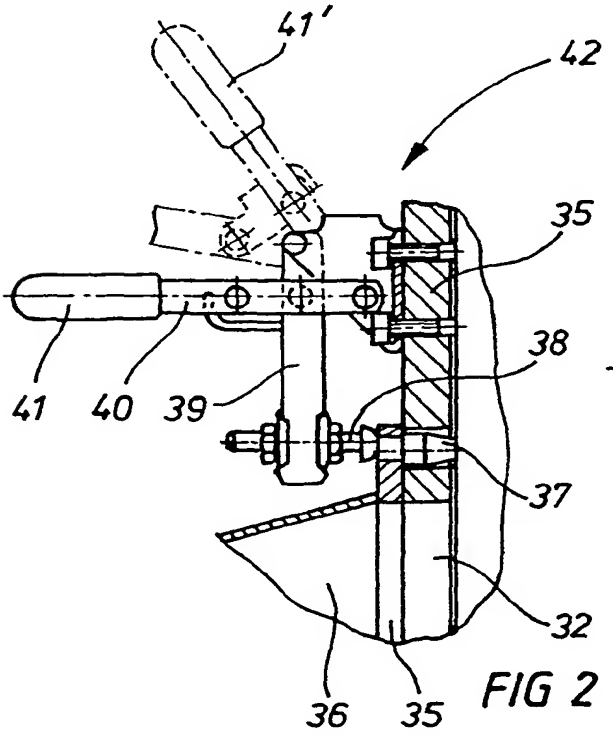

FIG 2

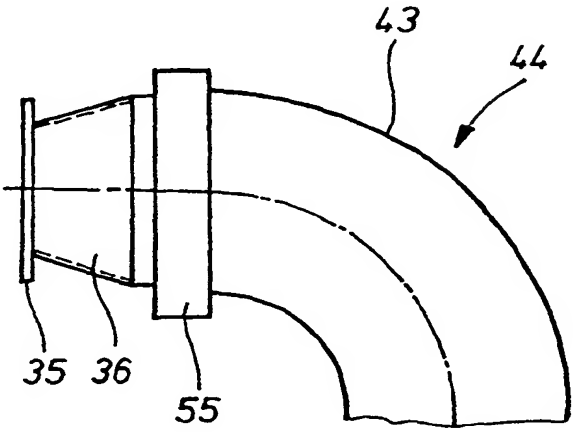

FIG 6

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COATING MACHINE

This invention relates to a coating machine with counter-flow and parallel-flow air conduction for coating tablets, granules, pellets, dragees and the like with one or more coating compositions, of the type wherein the cores to be coated are arranged in a rotatably driven, perforated drum mounted on a housing which comprises an air conducting channel surrounding the drum at its outer periphery, which air channel is provided with air from an air supply fixed to a housing, with air streams differently directed into the drum, the drum further comprising a pivot bearing which is constructed as a hollow shaft and through which an additional axial air stream can be conducted out of the drum.

A coating machine of the aforementioned type is known in which counter-flow and parallel-flow air conduction takes place via an air distributor, which is rigidly installed in the housing on the rear side of the rotatable drum and in which air distribution for the purpose of counter-flow or parallel-flow conduction takes place by the switching of valves in the air distributor. Air conduction here takes place in a closed system without loss of air, and it is possible to switch from a parallel-flow drying process to a counter-flow one. In addition, extraction of air from the interior of the drum through the hollow shaft of the drum is known. For control of air conduction in the known coating machine, a total of at least three air valves are required, each of which must be driven accordingly. As a result, however, there arises the disadvantage of a relatively costly air distributor, and furthermore operational reliability in driving the valves cannot always be guaranteed, because there is no clear indication as to whether the valve has in actual fact been switched in the desired manner or not. Moreover, the air

distributor itself and the air conducting channels of the housing and drum covered by the air distributor can be cleaned only with difficulty.

The present invention consists in a coating machine for coating cores such as tablets, granules, pellets, dragees and the like with one or more coating compositions, said machine comprising a housing; a coating drum for holding said cores, said drum having a perforated peripheral wall and being rotatably mounted on said housing by means of a rotary bearing formed as a hollow axial shaft communicating with the inside of said drum for removal of an axial air stream therefrom; means within said drum for providing a flow of at least one coating composition for said cores; and an air supply and distributor system for providing air flows parallel and countercurrently to said flow of coating composition, wherein said air supply and distributor means comprises; an air conducting channel surrounding the perforated peripheral wall of the drum, a plurality of part-annular chambers, separate from one another, arranged around the rotational axis of the drum and fixed relative to the housings, each of said chambers being in airtight communication with said air conducting channel at a different circumferential position and one of them communicating with the inside of the drum via the hollow axial shaft, and a distributor plate which carries air supply and outlet connections and is secured to said part-annular chambers so as to form outer walls for each of them, the distributor plate being rotatable relative to the housing to bring said air supply and outlet connections into alignment with different ones of said part-annular chambers to vary the direction of airflow through the drum as required.

By means of the present invention there can be provided a coating machine with an air distributor which is substantially cheaper to manufacture than in conventional machines. Furthermore, air conduction can be made

operationally reliable and the air distributor and the housing and drum parts covered by the air distributor are easy to clean.

It is an advantageous feature of the present invention that an air distributor can be provided without switchable valves, the air distributor instead essentially comprising an annular distributor plate which is constructed rotatably, so that by rotation of the distributor plate, the corresponding air inputs and outputs to the drum can be switched. As a result there is positive control of air conduction, without the need to drive different valves. The result of this is good operational reliability, for according to rotation of the rotatably mounted distributor plate, the required air conduction inevitably follows.

Because the air distributor is designed as an ordinary annular distributor plate, there is also the added advantage that this distributor plate is mounted easily and removably in the housing and that with removal of the distributor plate, the correspondingly arranged chambers on the housing side for air conduction and also the air conducting channels on the drum side are readily accessible for cleaning.

In a particularly preferred embodiment the air connections leading into the distributor plate are connected by quick-action fastenings to the distributor plate, so that when the distributor plate is dismantled, the air connections are easily removable by releasing the associated quick-action fastenings.

Throughout operation of the coating machine, however, the distributor plate remains in place and the air connections remain connected to the distributor plate. The air connections are preferably rotatable in such a way (e.g. by rotary couplings) that, with rotation of the distributor without having to be removed, they perform each revolution of the distributor plate with it.

The result is a particularly simple and cheap air distributor system in which all three operating states are possible, namely either counter-flow air conduction (outgoing air from above, incoming air from below), parallel-flow air conduction (incoming air from above, outgoing air from below) or additional air extraction via the hollow shaft, namely outgoing air from the interior of the drum through the hollow shaft to the outside and incoming air from below into the charge of the drum.

A preferred embodiment of the invention will now be described with reference to the accompanying drawings wherein:

FIG. 1 shows schematically a section through a coating machine showing the directions of air conduction;

FIG. 2 shows a detail of Figure 1, namely a section through a quick-action fastening;

FIG. 3 is a view of the rear side of the air distributor system, showing the position of the air distributor during counter-flow air conduction;

FIG. 4 is a view similar to that of Figure 3 showing air extraction through the hollow shaft and supply of incoming air from below;

FIG. 5 is a view similar to that of Figure 3 during parallel-flow air conduction; and

FIG. 6 is a side view of the air connecting branch of the machine shown in Figure 1.

Referring first to Figure 1, a drum 1 of a coating machine is mounted rotatably in a housing of the coating machine, which housing may be of a conventional type and is not shown in more detail, and rotationally driven by a drive mechanism, again not shown in more detail.

The drum is closed at the front (on the operating side of the coating machine) by a window 5 which closes the opening 6 of the drum 1.

In the interior 8 of the drum 1, the charge 12 is arranged near the bottom of the drum. The drum comprises

perforated drum walls 7.

Around the outer periphery of the drum walls 7 is aranged a peripheral air conducting channel 2 which forms an annular chamber through which air streams are conducted into and out of the drum.

The air conducting channel 2 is closed at its radially outer end (at different surfaces of the periphery) in each case by a valve 3 which can be operated with a handle 4. The valve 3 is in this case mounted pivotably in the side walls of the air conducting channel 2.

In the interior 8 of the drum 1 are arranged one or more spray arms 9, the spray arm 9 carrying several nozzles 10 which are suitable for spraying a coating composition or a cleaning fluid in the direction of the arrows 15 (spray jet).

Projecting perpendicularly from the spray arm 9 is arranged an additional arm 11 with additional spray nozzles.

According to the air conduction in the drum 1 selected by the air distributor, which will be described below, there can be either a flow 13 of air conduction parallel with the spray jet 15 or a counter-flow 14 of air conduction counter to the spray jet 15. In addition, extraction of air from the drum contents in the direction of the arrow 16 through the hollow shaft 17 of the drum 1 to the outside can be effected selectively.

The drum 1 is in this case mounted rotatably in a bearing 18 and is driven in rotation by the rotary drive mechanism. The spray arm 9 passes through the rotating hollow shaft 17 and can be fixed to the housing by insertion in a connection 20.

In the hollow shaft 17 there is sealingly engaged a stationary connecting branch 19 from which a connection piece 21 branches off perpendicularly, so that the air flowing out of the interior 8 of the drum 1 in the direction of the arrow 16 through the hollow shaft 17 is conducted in the direction of the arrow 22 through the

connection piece 21 into an annular chamber 23 which is defined by a pair of coaxial annular flanges 34 fixed to the housing.

The annular flanges 34 form a self-contained annular chamber, and are accommodated on a stationary mounting plate 24. Between the mounting plate 24 and the rotating drum wall 26 is arranged a rotational seal, to allow air conduction out of the annular chamber 23 defined between the concentric flanges 34 into the air conducting channel 2 of the drum 1.

The rotational seal in this case comprises two concentric grooves 28 which are mutually spaced apart by a radial distance and opposite which are aligned concentric grooves 29 in the region of the drum wall 26.

The two pairs of grooves 28, 29 are in each case filled with an annular seal 30.

With reference to Figure 1 in conjunction with Figures 3 to 5, it can be seen that the drum wall 26 is interrupted by part-annular slots 27, 47, 48 distributed around the periphery of the drum wall 26, each slot occupying only a given sector of the periphery.

Opposite and aligned with the slots 27, 47, 48 in the drum wall 26, slots 25, 57 are formed in the mounting plate 24.

On the other side of the mounting plate (in a direction towards the housing and facing away from the front side of the drum), the annular flange 34 described above are arranged, and are internal with the mounting plate 24. These annular flanges 34 define between them part-annular chambers 23a, 23b, 23c, which are separated from each other by dividing webs 49, 50, 51 distributed around the periphery of the annular flange, so that the part-annular chambers 23a-c are in the form of separate sectors.

Air supply to the annular chamber 23 takes place <u>via</u> a distributor plate 31 which covers the annular chamber 23 at the front as required or connects it in an

airtight fashion to corresponding air inlets and outlets.

In the operating position of the distributor plate 31 shown in Figure 3, incoming air is supplied in the direction of the arrow 52 to an air connection 56, so that the air passes through a slot 46 in the distributor plate 31 into the chamber 23b between the annular flanges 34 and there passes through a slot 48 in the drum wall 26 into the lower air conducting channel 2 of the drum, so as to flow in the direction of the arrow 14 in counter-flow through the charge 12.

As Figure 1 shows a section along the line I-I in Figure 4, it can be seen from Figure 4 that in this operating position the slot 27 has been cut in the wall of the drum 1, while in Figure 3 an additional slot 48 (not visible in Figure 1) is provided in the drum wall 26, so that there is an airtight connection of the air connection 56 into the lower air conducting channel 2.

At the same time the outgoing air is conducted away via the upper air conducting channel 2 out of the drum. This is achieved by the fact that in the drum wall on the upper side there is a slot 47 opposite which, in the position shown in Figure 1, is aligned a slot 57 in the mounting plate 24. At the same time the distributor plate 31 also comprises a slot 32 in this region, so that an airtight connection passes from the upper air conducting channel 2 of the drum via the slots 47, 57, 32 into the air connection 44 adjoining this slot 32 in the distributor plate 31. The air thus flows in the direction of the arrow 45 out of this air connection 44.

Air extraction via the hollow shaft 17 does not take place in the configuration shown in Figure 3, as the connection piece 21 leads into the part-annular chamber 23a and this chamber 23a is closed off by the dividing webs 49, 50 from the other part-annular chamber 23c, which is open in Figure 3.

If the distributor plate 31 is rotated further in

the direction of the arrow 53 (clockwise), then the slot 32 in the distributor plate 31 passes into the region of the chamber 23a for conducting away the outgoing air. Air extraction then takes place as shown in Figure 1.

Since the connection piece 21 also leads into the chamber 23a (cf. Figure 1), the air is conducted away both in the direction of the arrows 16, 22 out of the interior 8 of the drum and in the direction of the arrow 45 through the air connection 44 out of the chamber 23a.

At the same time incoming air is supplied in the direction of the arrow 52 through the lower air connection 56, wherein the slot 46 in the distributor plate 31 comes into register with the slot 48 in the drum wall 26, so that the air flows in the direction of the arrow 52 (Figure 4) into the drum.

Thus, incoming air is supplied in counter-flow 14 from below as shown in Figure 1.

If the distributor plate 31 is further rotated clockwise in the direction of rotation 54 as shown in Figure 4, then the air conducting pattern shown in Figure 5 arises.

In this position of the distributor plate 31 there is parallel-flow air conduction, because incoming air flows from above (parallel flow 13) and outgoing air from below (in the direction opposite the direction of the arrow 14 in Figure 1).

In this case the air connection 56 which supplies the air in the direction of the arrow 52 has its slot 46 in the distributor plate 31 in register with the part-annular chamber 23c.

On the other hand, the outgoing air is conducted away in the direction of the arrow 45 through the open part-annular chamber 23b, so that the air flows away in the direction of the arrow 45 through the air connection 44. There is no air extraction through the hollow shaft 17 because the chamber 23a is hermetically sealed by the

dividing webs 49, 50.

The distributor plate 31 is rotatably mounted as shown in Figures 1 and 3-5. At the outer periphery of the distributor plate 31, as shown in Figures 3-5, or its inner periphery as shown in Figure 1, are arranged several knurled screws 33 which can be screwed into fixed threaded bores in the housing.

The knurled screw 33 is thus applied by its flange to the outer surface of the distributor plate 31, so that the distributor plate 31 can be pressed firmly against the faces of the annular flange 34 by tightening the respective knurled screws 33.

If the distributor plate 31 is to be turned in the direction of the arrows 53, 54, then the knurled screws 33 are slightly loosened, as a result of which the distributor plate 31 can easily be turned together with the air connections 44, 56 mounted thereon. In this case it is not necessary to remove or reposition the air connections 44, 56, which results in a substantial saving of labour.

The air connections 44, 56 thus remain constantly connected to the distributor plate 31.

In order to make the distributor plate easily removable (e.g. for cleaning purposes), the air connections 44, 56 are mounted for easy removal on the distributor plate 31. So-called quick-action fastenings 42 are provided for this, which will be described in more detail with reference to Figures 1 and 2.

The upper air connection 44 comprises a pipe bend 43 which is mounted rotatably in a threaded connection piece 55. The threaded connection piece 55 is here rigidly attached to one end of a connecting branch 36, the other end of which is attached by the quick-action fastening 42, which will be described in more detail, and by a flange 35, to the distributor plate 31, overlapping the slot 32.

The mounting is in this case easily detachable by the toggle lever fastening shown in more detail in Figure

2. The toggle lever fastening essentially comprises a bolt 38 which is attached to the free front end of a lever 39, which lever is mounted pivotably in a bearing point on a second lever 40, which lever 40 is constructed as a clamping lever and has a handle 41.

In Figure 2 is shown in unbroken lines the clamping position of the lever 40 and in dot-and-dash lines the open position of the lever 40.

In the clamping position, the bolt 38 presses firmly on the flange 35 of the connecting branch 36, so that the latter is pressed close against the distributor plate 31 in the edge region of the slot 32. Naturally, in this case several quick-action fastenings 42 distributed over the periphery are necessary to ensure that the flange 35 is seated sealingly and quickly removably on the distributor plate 31. A pin 37 is inserted in the distributor plate 31, which prevents the flange 35 from shifting.

The bend 43 then merges into a connecting hose 58.

On rotation of the distributor plate 31 in the direction of the arrows 53, 54, it may be provided that the threaded connection piece 55 must be slightly loosened in order to ensure rotation of the bend 43 in the threaded connection piece 55.

The lower air connection 56 is also connected to the distributor plate 31 in an analogous manner.

Figure 6 is a side view of this type of air connection 44.

It is important that by releasing the quick-action fastenings 42, the distributor plate 31 becomes free to the rear (in a direction towards the housing), so that it can be removed upwardly by undoing and completely removing the knurled screws 33 rearwardly (perpendicularly to the plane of the drawing in Figures 3-5). As a result the annular chamber 23, the mounting plate 24 with its slots fixed to the housing and also the drum wall 26 become freely

accessible for cleaning purposes. Hence the air conducting channel 2 can easily be cleaned with all the slots and openings described above.

By corresponding rotation of the distributor plate 31 into the various operating positions shown in Figures 3-5, positive guiding of the air streams is always achieved without the need here to operate different valves, the position of which cannot be checked exactly. Air conduction which is particularly reliable in operation and which is designed particularly simply is therefore achieved.

With the simple rotary mounting of the distributor plate 31, it is also possible to drive the distributor plate in rotation with a motor. For this it is sufficient to provide, for example at the outer periphery of the distributor plate, corresponding teeth which mesh with a pinion of a drive motor, not shown in more detail. By driving the drive motor in both directions of rotation, therefore, the distributor plate can be rotated by electric motor into the various operating positions shown in Figures 3-5.

CLAIMS:

1. A coating machine for coating cores such as tablets, granules, pellets, dragees and the like with one or more coating compositions, said machine comprising:

a housing;

a coating drum for holding said cores, said drum having a perforated peripheral wall and being rotatably mounted on said housing by means of a rotary bearing formed as a hollow axial shaft communicating with the inside of said drum for removal of an axial air stream therefrom;

means within said drum for providing a flow of at least one coating composition for said cores; and

an air supply and distributor system for providing air flows parallel and countercurrently to said flow of coating composition, wherein said air supply and distributor means comprises;

an air conducting channel surrounding the perforated peripheral wall of the drum,

a plurality of part-annular chambers, separate from one another, arranged around the rotational axis of the drum and fixed relative to the housings, each of said chambers being in airtight communication with said air conducting channel at a different circumferential position and one of them communicating with the inside of the drum via the hollow axial shaft, and

a distributor plate which carries air supply and outlet connections and is secured to said part-annular chambers so as to form outer walls for each of them, the distributor plate being rotatable relative to the housing to bring said air supply and outlet connections into alignment with different ones of said part-annular chambers to vary the direction of airflow through the drum as required.

2. A coating machine as claimed in claim 1, wherein the airtight connection between the part-annular chambers fixed relative to the housing and the air conducting channel around the drum periphery is formed by a rotational seal.

3. A coating machine as claimed in claim 1 or claim 2 wherein said air supply and outlet connections are attached to the distributor plate by quick-action fastenings.

4. A coating machine as claimed in any preceding claim wherein each said air connection is attached rotatably to the distributor plate.

5. A coating machine as claimed in any preceding claim wherein the hollow shaft of the drum is attached at its end outside the drum to a stationary connecting branch which on the one hand forms an airtight connection via the hollow shaft to the interior of the drum and on the other hand forms an airtight connection via a connection piece to one of said part-annular chambers.

6. A coating machine as claimed in claim 1 wherein the distributor plate is annular and is secured in position by knurled screws arranged at its inner or outer periphery, which screws can be loosened to allow rotation of the distributor plate.

7. A coating machine as claimed in any preceding claim further comprising a motor arranged to drive the distributor plate in rotation.

8. A coating machine as claimed in any preceding claim comprising a pair of concentric annular flanges which define three said part-annular chambers, said chambers

being separated from each other by dividing webs and being connected in an airtight manner by a rotational seal to the air conducting channel surrounding the drum.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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9124278.4

Relevant Technical fields

(i) UK Cl (Edition K) B2L LCPA

(ii) Int Cl (Edition 5) B05B 15/00

Search Examiner
M ELLIOT

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
12 FEBRUARY 1992

Documents considered relevant following a search in respect of claims 1 AT LEAST

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	1 AT LEAST

:egory	Identity of document and relevant passages	Relevant to claim(s)

:ategories of documents

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